THE CENTER

U.S. Department of Agriculture
Agricultural Research Service
The Western Regional Research Center
800 Buchanan Street
Albany, CA 94710

Volume II, Issue 2 September 1996

Wheat Research at the Western Regional Research Center

Altering Wheat Grain Components

WRRC researchers have shown, for the first time in any cereal, that a major protein component of the seed can be modified both in quantity and quality. The wheat transformation and promoter technology that makes this possible were both developed at WRRC.

Currently, WRRC researchers are altering seed fractions called high-molecular-weight glutenins, which are the proteins that confer much of the unique viscoelastic properties to wheat doughs and are critical for processing characteristics. The results from these experiments show the modified genes can be expressed at high levels in the seed, are seed specific, and are stably inherited.

It is now possible to plan rational modifications of all wheat (and other cereal) components by either direct modification of proteins or alterations in the enzymes which produce these seed fractions.

A U.S. patent application has been filed on this technology. WRRC is seeking licensees.

Contact: Olin Anderson
510/559-5773

Improving Grain Quality

High temperatures during wheat grain filling adversely affect grain yield and flour quality. Scientists at WRRC are investigating the effect of high temperatures on the developing wheat grain in order to learn how heat affects the synthesis and physical properties of the wheat storage proteins.

WRRC scientists have discovered a non-gluten protein, referred to as a heat shock protein, that increases and accumulates in grain from heat treated plants. The sequences encoding this protein have been cloned and the expression of this gene is being analyzed in developing wheat seeds exposed to high temperatures. This is a first step in an effort to develop wheat varieties that exhibit consistently high flour quality despite being grown under adverse environmental conditions.

Contact: William Hurkman
510/559-5750

Defining the Basis of Gluten Elasticity

Scientists at WRRC are also investigating the molecular structures that make wheat doughs elastic. Glutenins form during protein synthesis from gluten protein subunits. In glutenin polymers, subunits are linked into chains by several distinct types of disulfide bonds. The ratio between types of bonds affects the balance of elasticity relative to extensibility in doughs. Since environmental factors can affect polymer formation, grain of different cultivars or even from different lots of the same cultivar may vary considerably in terms of dough characteristics.

Researchers at WRRC have been defining the bond arrangements in gluten proteins in order to facilitate genetic engineering of improved wheat cultivars. In order to provide further understanding of the elastic nature of doughs, glutenin subunits, and genetically engineered variations are being expressed in bacteria and wheat by WRRC molecular biologists. This research may also have applications in the development of novel films and fibers.

Contact: Donald Kasarda
510/559-5687

Taking Wheat Apart

Wheat is principally a source of bread, cake, and pasta flour, but may also be a source of a variety of products including fermentation ethanol, industrial products and non-traditional foods which make use of the unique character of wheat starch and protein fractions. Effective use of wheat in these non-traditional roles requires new, efficient separation and conversion technologies.

WRRC wheat fractionation research has resulted in a novel approach in which a benign solvent (absolute ethanol) is used to fractionate wheat into starch and protein. This alternative to the conventional aqueous method has potential for reducing process water use and pollution, reducing energy use; and improving the quality and variety of separated products.

WRRC researchers are also tailoring starch-degrading enzymes by a combinatorial/ molecular evolution approach. Enzymes with enhanced activity at low temperatures are being targeted both to reduce the energy used in conventional starch liquefaction, and for processes where whole-grains are utilized, to preserve the functionality of proteins for subsequent recovery.

Contact for wheat separation:
George H. Robertson
510/559-5866

***Contact for combinatorial enzymes*:**
Dominic Wong
510/559-5860

Making Novel Materials with Wheat

Researchers at WRRC have developed a new method of making lightweight concrete using wheat starch and other renewable biomaterials. The new process incorporates small void spaces uniformly throughout the matrix of the concrete. Unlike aerated concrete, the starch-based concrete can be poured to considerable depths and still maintain a uniform density.

The starch-based concrete can also be made by a process that leaves an attractive surface finish. Thus, concrete made using this process may not need further finishing before being used in construction or for decorative elements.

Initial tests performed at WRRC indicate that, although the concrete is not as strong as regular concrete, it may have enhanced sound proofing and other characteristics. Concrete samples are currently being sent to an independent laboratory for more extensive testing.

A U.S. patent for this technology has been allowed. WRRC is seeking companies interested in licensing this technology.

Contact: **Greg Glenn**
510/559-5677

How Do Businesses Get Access to These Technologies?

WRRC is seeking private companies interested in licensing technologies which have been patented or for which a patent application has been filed. For other projects we are looking for companies interested in becoming our partners in Cooperative Research and Development Agreements (CRADAs). CRADA partners have the first right to negotiate an exclusive license for each invention which is made as part of the CRADA. We encourage small and minority-owned business to take part in our technology transfer programs.

The Center is a quarterly newsletter compiled by WRRC to alert potential partners of technology transfer opportunities.

Antoinette A. Betschart
Director
Phone: 510/559-5600
Fax: 510/559-5963
E-mail: abetschart@pw.usda.gov

Martha Bair Steinbock
Technology Transfer Coordinator
Phone: 510/559-5641
Fax: 510/559-5963
E-mail: mbsteinbock@pw.usda.gov